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(51) INT CL<sup>4</sup>

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GB 1589158

EP 0088886

GB 0327583

(58) Field of search:

B7B

## (54) Gull-wing door trailer

(57) Provision of gull-wing doors as well as conventional rear swing doors 50 permits unhindered access to the interior of a trailer 10 along the full length of the trailer. Each gull-wing door 40 or 42 is pivoted longitudinally at the approximate centre of the roof 46 and includes a roof portion which extends outwardly from the pivot axis and an integral sidewall portion which extends downwardly. A pair of hydraulic cylinders 58 are pivotally secured between the roof portion of each door 40 or 42 and a fixed trailer frame element and are oriented substantially horizontally when the door is in its closed position. Torsion bar spring assemblies 60 disposed colinearly with the axis of pivoting provide a force which initially opens the doors, so offsetting the hydraulic cylinders 58 from their substantially horizontal positions that they are capable of providing sufficient torque to raise the doors.

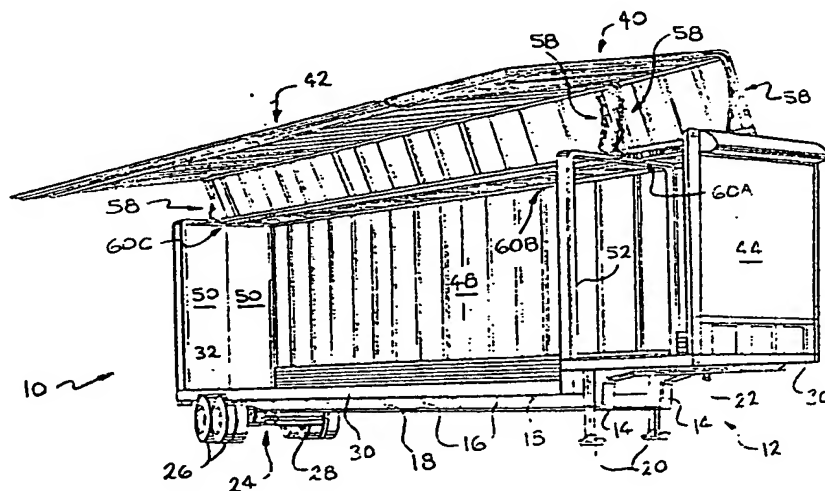


FIG 1

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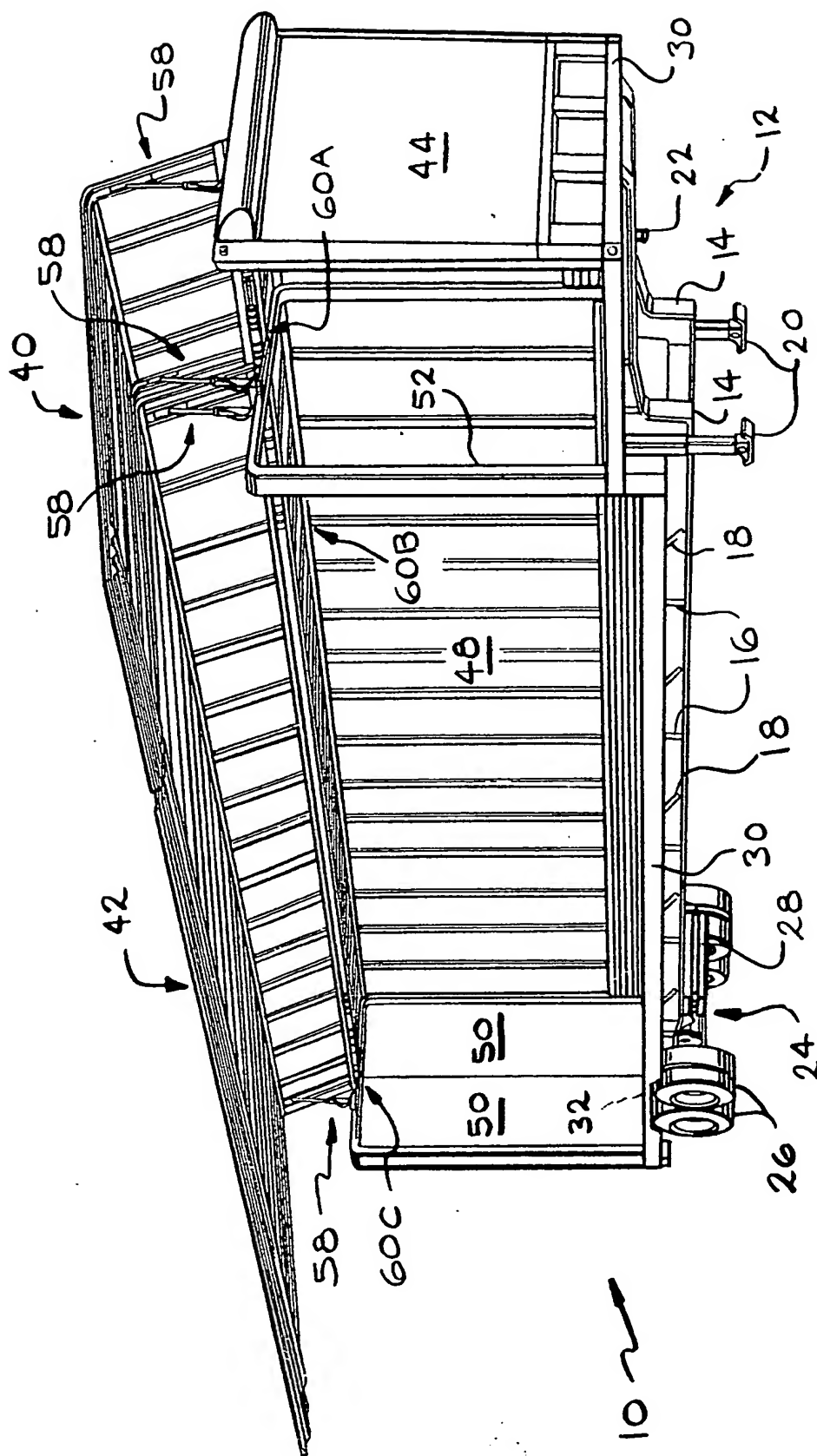


FIG 1

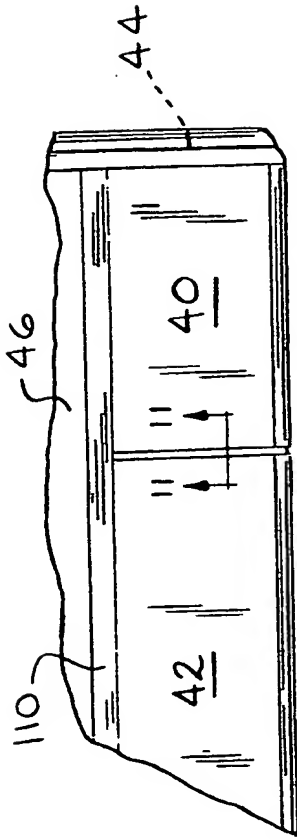


FIG. 3

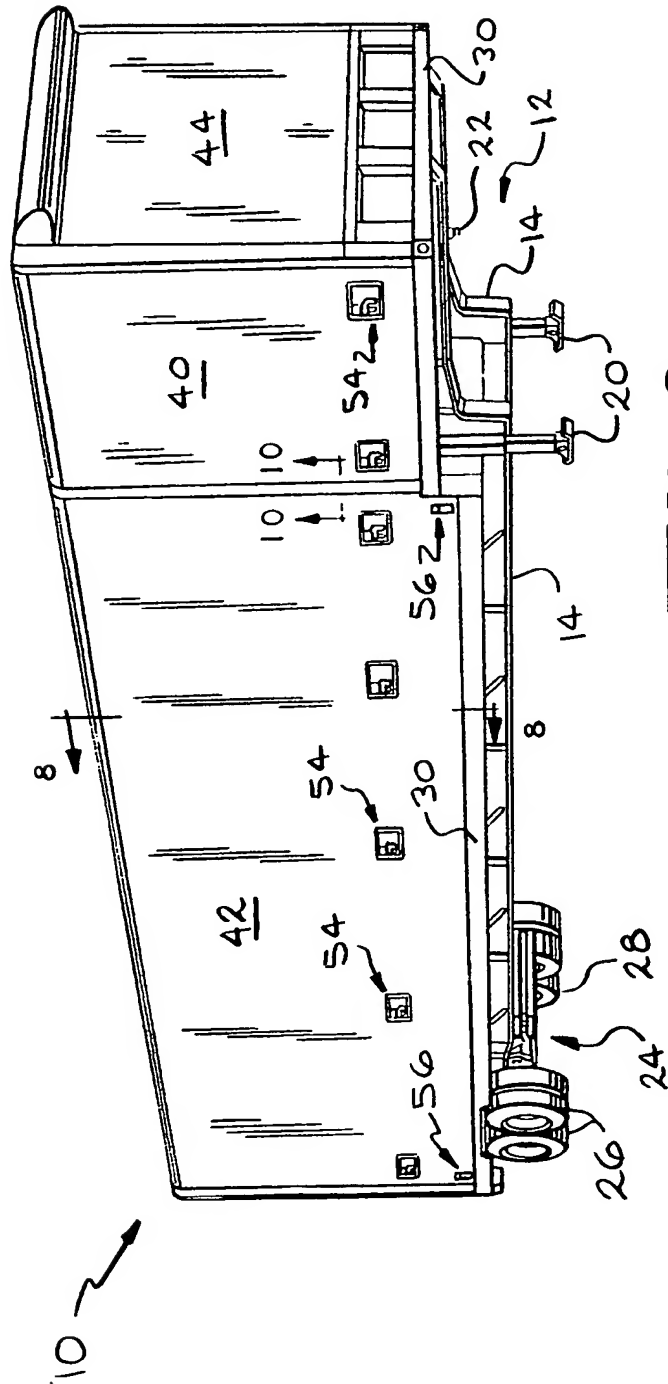


FIG. 2

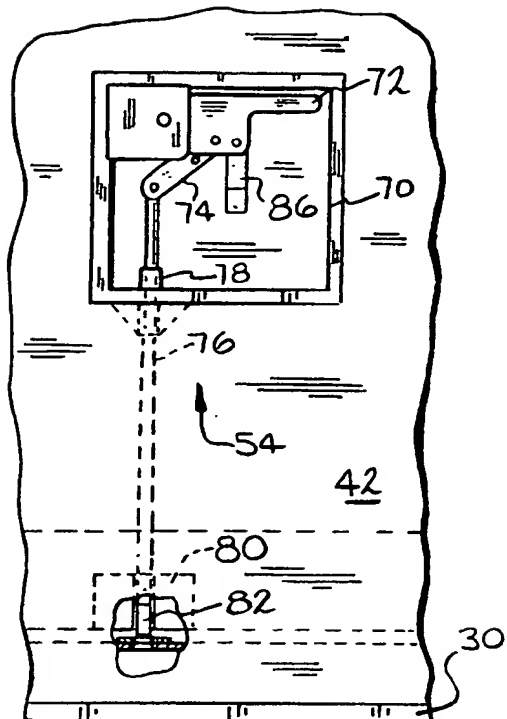


FIG. 4

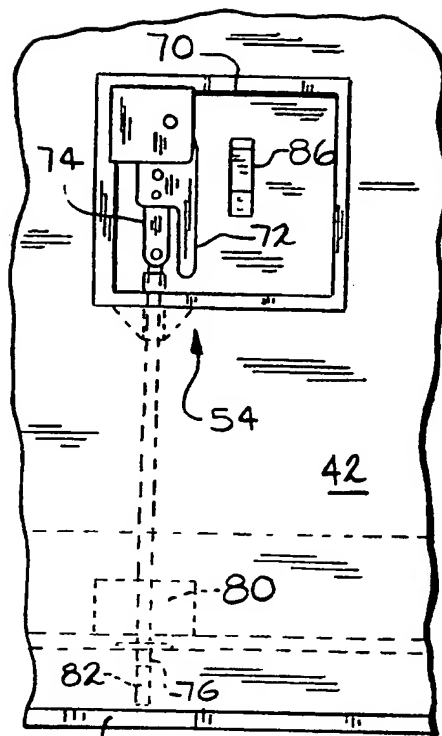


FIG. 5

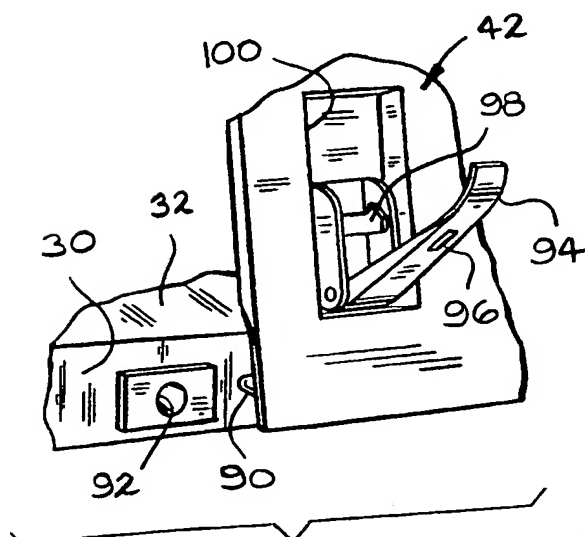


FIG. 6

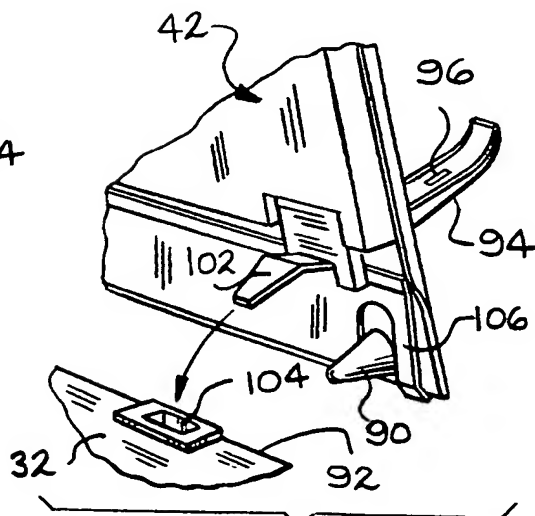
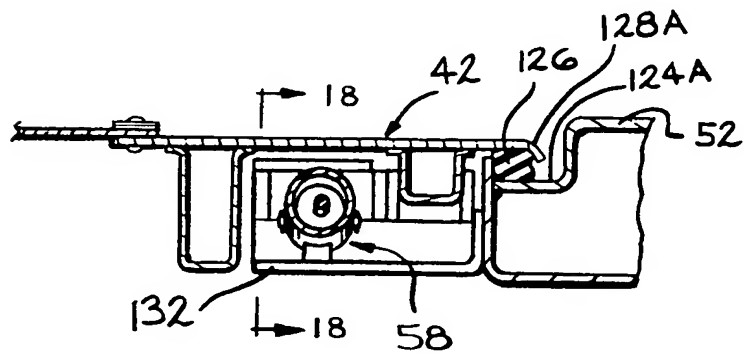
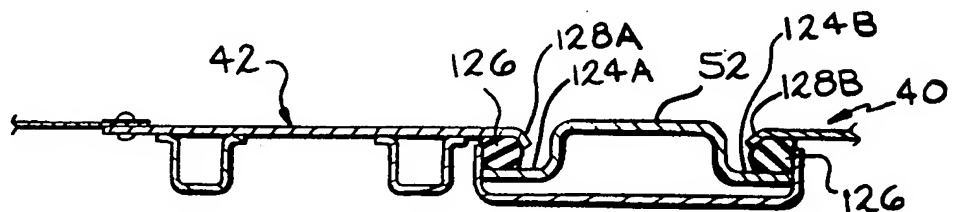
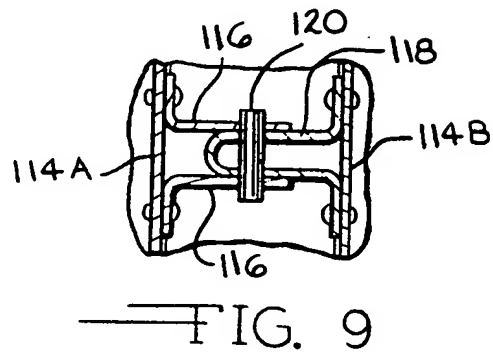
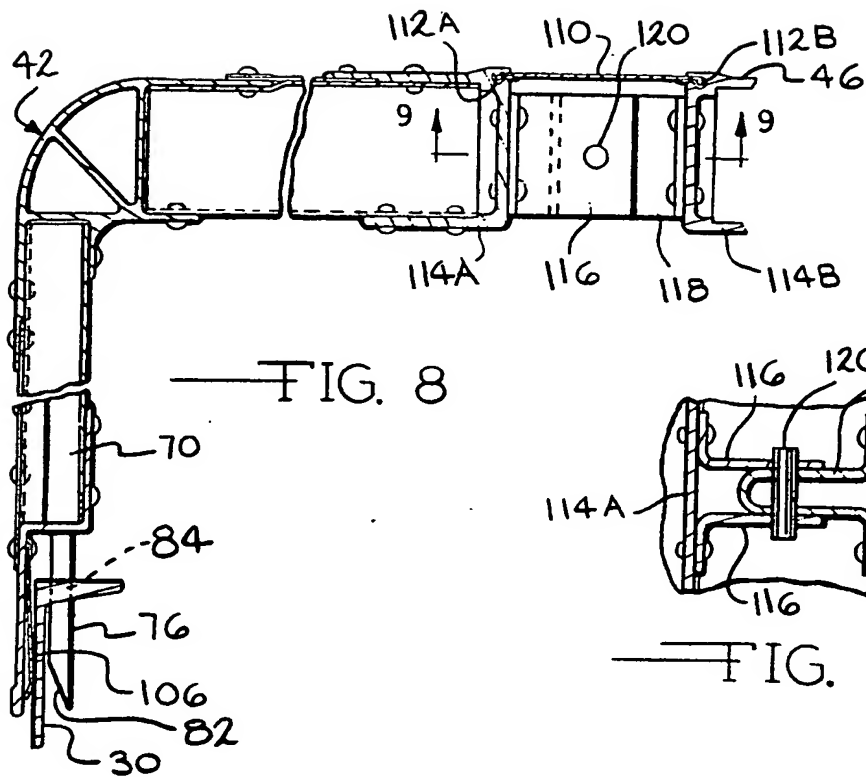
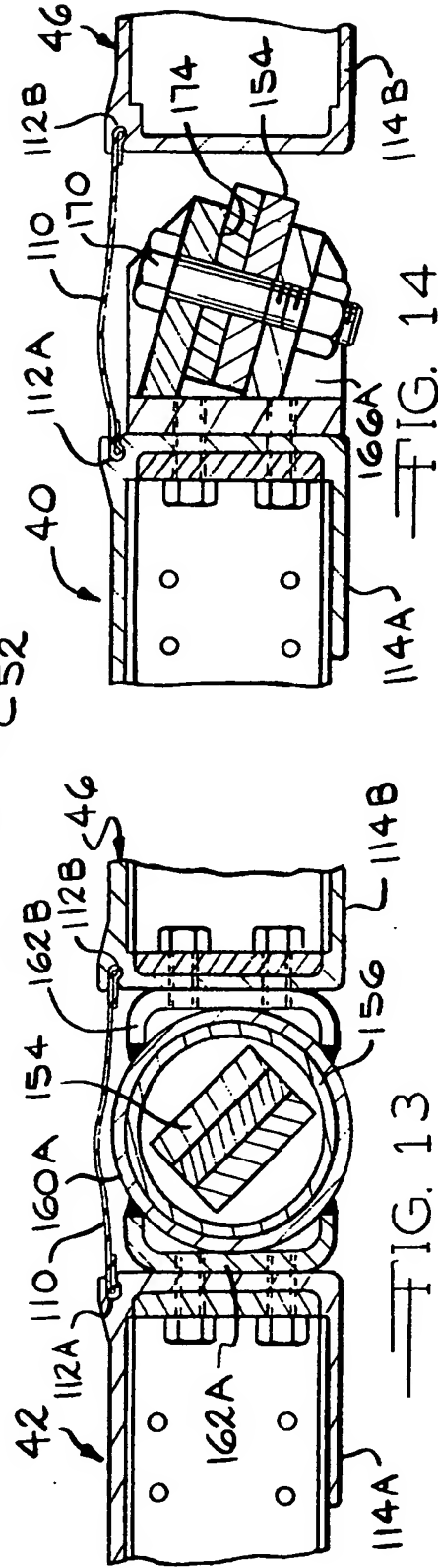
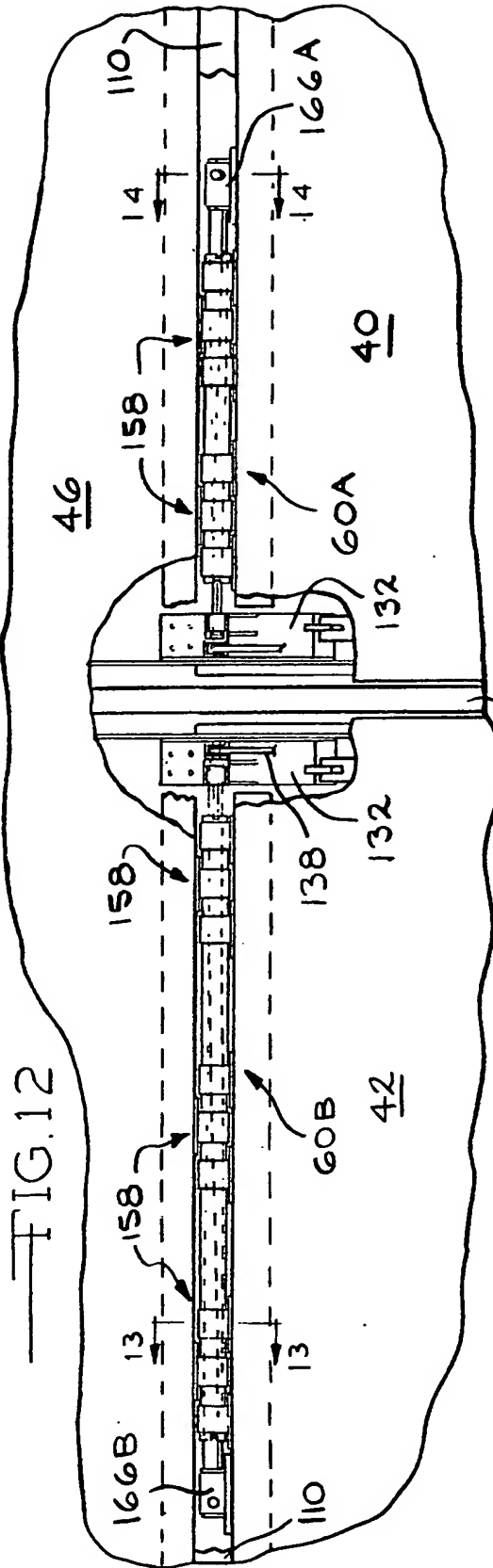
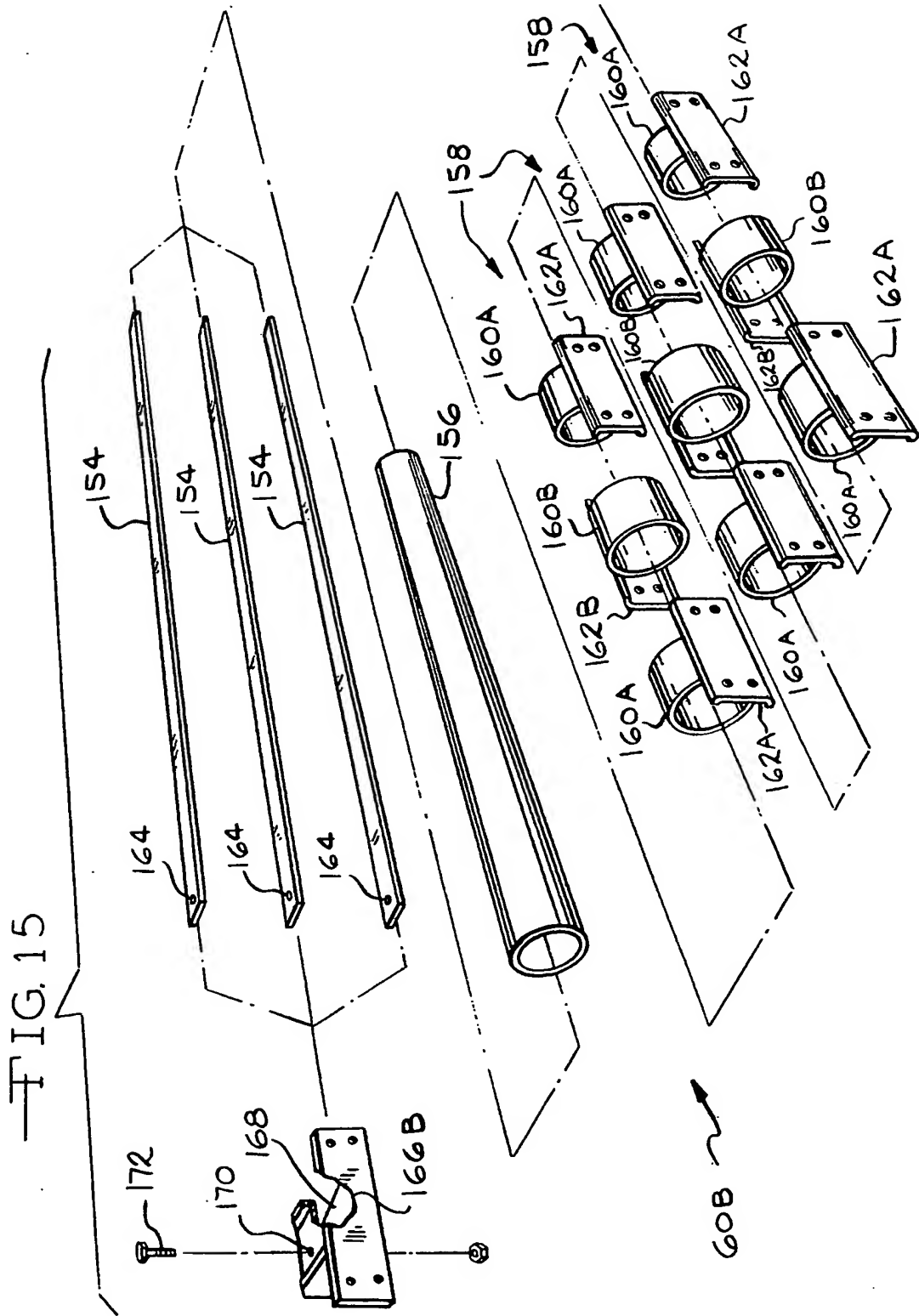
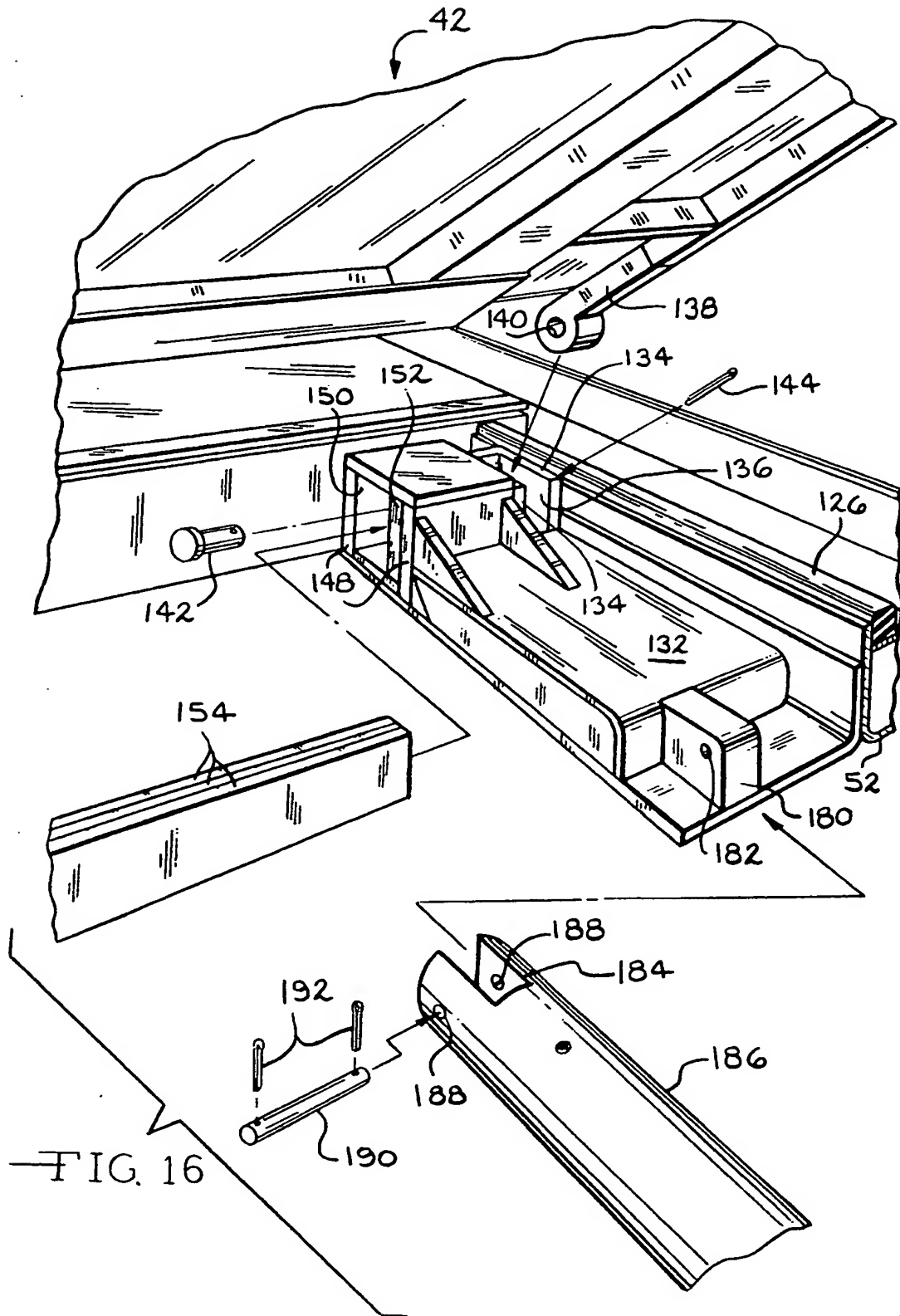


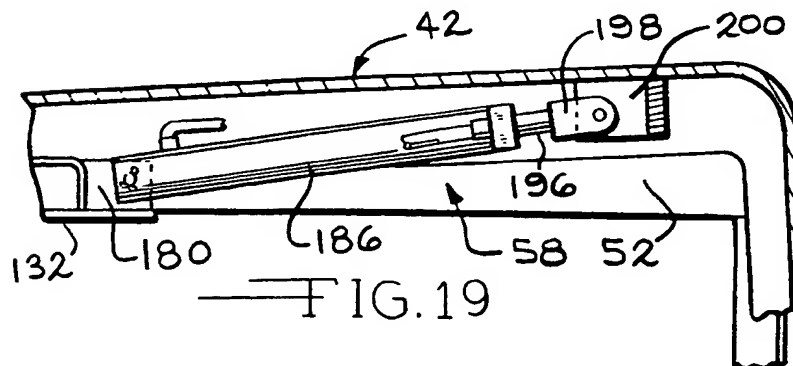
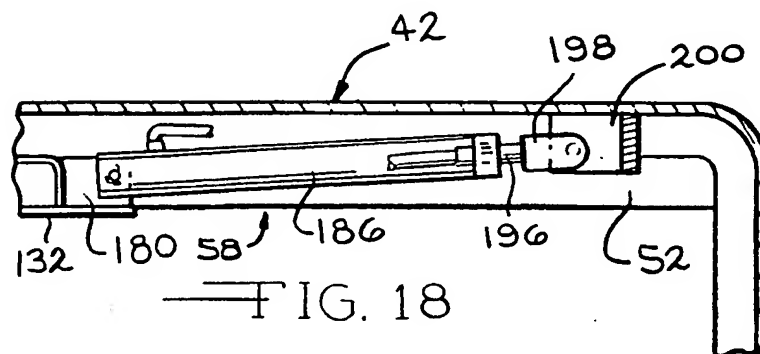
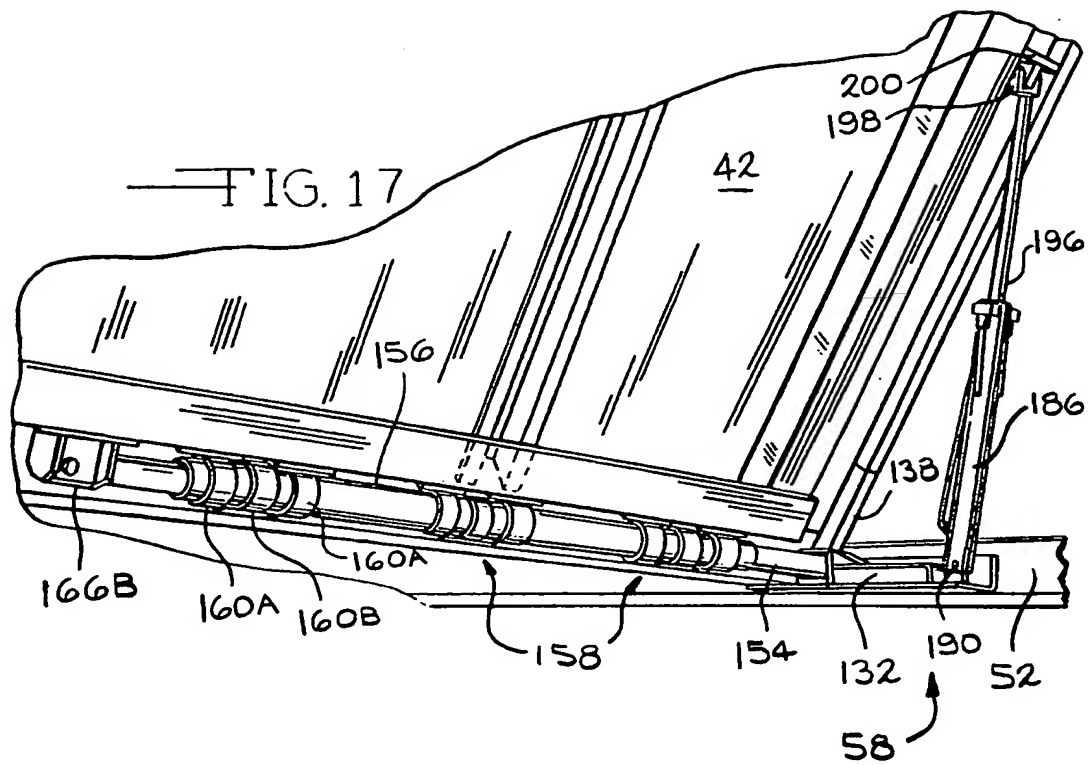
FIG. 7











## SPECIFICATION

## Gull-wing door trailer

5 The invention relates generally to enclosed, cargo transporting trailers and more specifically to such a trailer having at least one gull-wing door which opens to provide unobstructed access to the trailer from the side.

10 A conventional cargo trailer, the workhorse of the transportation industry, can be accurately and simply described as an elongate, wheeled container having a width of approximately 2.5 metres, an interior height of between 2.5 and 3 metres and a length between 10 and 15 metres. The top, side-walls and bottom of the trailer are typically rigid panels and access to the interior is generally provided by a pair of hinged, rear doors. While that straightforward design has well served the needs of the transportation industry and those dependent thereon, certain disadvantages are inherent in that design.

It is readily apparent that cargo disposed in an elongate trailer to the interior of which access is available only through one end must be loaded and unloaded sequentially. Several consequences devolve from such restricted access. First of all, since the cargo must be loaded in a sequential fashion, the time need for loading and unloading tends to be greater than it would be if access to a greater portion of the trailer could be obtained at one time, thereby facilitating unloading of greater portions of cargo at one time or through simultaneous utilization of plural unloading agencies such as a plurality of lift trucks. Secondly, if the cargo consists of disparate articles, it is preferable to load the trailer in the inverse order in which such disparate cargo will be utilized. If that is not done, it may be necessary to unload substantially the entire cargo before certain first-needed cargo can be retrieved from the trailer. Such a situation has obvious time loss consequences which generally can be overcome only by involving the shipping entity with the material handling requirements of the receiver. Such involvement places a premium on communication and an undue burden on the shipper.

Another difficulty of end-loading trailers also relates to the loading/unloading procedure, creates delays and increases the overall time spent in this activity. This difficulty relates to the handling and return of empty parts baskets, pallets or other empty cargo-carrying devices. Since none of the empty cargo-carriers can be returned to the trailer at the cargo utilization site until all of the filled cargo-carriers have been removed, numerous additional movements of transport vehicles such as forklifts and additional engagements and disengagements of the cargo carriers by such forklifts are necessitated. For example, a bin or basket may be removed from a trailer and transported to a utilization site in a manufacturing facility where a similar empty bin or basket may be engaged and returned to the loading dock.

65 Until the trailer has been fully emptied, however,

70 the empty carrier cannot be placed within the trailer. This problem can be brought into sharp relief by envisioning a trailer design and system whereby cargo carriers can be removed from the trailer and transported to their utilization site while empty carriers can be returned to the trailer and placed in the space just vacated.

Recent, significant shifts in production methods, inventory techniques and management theories are directed toward the reduction of manufacturing site inventory, compensated for by rapid and timely delivery of components heretofore warehoused by the user. Such manufacturing and inventory control schemes emphasize, and in fact require, rapid movement of material transported on commercial trailers which is assisted by timely loading and unloading. It has been determined that side-loading trailers facilitate such rapid loading and unloading as well as generally addressing the difficulties heretofore noted. Side-loading trailers further facilitate handling of material of great length such as lumber, pipe and similar elongate goods.

Side-loading trailers are known in the prior art. For example, United States Patent No. 4,302,044 discloses a trailer body having slidably-openable side panels as well as hinged top panels to provide access to the interior of the trailer in addition to that provided by conventional pivoted rear doors. United States Patent No. 3,815,518 discloses a railroad freight car having three sliding side doors that may be opened to provide access to two-thirds of one side of the trailer. While the procedures for unlatching and sliding the doors may be somewhat difficult and time consuming, a more significant difficulty of such designs is the simple fact that they cannot provide access to the entire side of a trailer or railroad car at one time. Such doors thus both interfere with simultaneous loading or unloading of the trailer or car and effectively reduce the maximum length of elongate cargo which can be conveniently loaded into and unloaded from the trailer or car.

A specific class of side loading trailers incorporates pivotable unitary roofs and sidewalls. Frequently, such designs comprehend a door comprising a roof panel approximately one-half as wide as the roof and an integral sidewall panel. Both sides of the trailer may include such pivoted, openable structures. Such designs are typically referred to as gull-wing trailers. The speed and ease with which such trailer designs provide internal access is great. Unfortunately, problems attendant on the configuration and operation of previously-proposed gull wing doors detract from their utility. For example, in order to minimize the mass of the gull-wing door, some designs comprehend lifting only the roof and upper portion of the sidewall. In such designs, the lower portion of the sidewall comprises one or more hinged panels. Gaining access to the interior of such trailers entails several manual operations and thus requires additional personnel, time, or both compared with a design in which the entire sidewall is secured to and opens with the roof portion. Another difficulty centres upon

the gull-wing opening mechanism. Because a gull-wing door is relatively massive and when it is initially moved from its closed position its centre of gravity is displaced horizontally from its axis of pivoting so that the weight of the door produced a large moment about that axis, the operating force necessary to open the door can be considerable and must be provided by operators of significant size and power. Bulky operators placed in the upper portion of a trailer can be disadvantageous since they may occupy significant internal volume and reduce the cargo-transporting capacity of the trailer. This difficulty is greater than would first be imagined since large cargo and parts baskets are often sized to occupy the whole of the internal width, height and length of a trailer. An operator housing of only centimetres in width and length may interfere with complete utilization of the vehicle's internal space. Unless the size of the cargo can be altered, an obstruction such as an operator housing may create unusable space between the housing and the trailer floor across the entire width of the trailer. From the foregoing, it should be apparent that improvements in the design of side-loading gull-wing trailers are both possible and desirable.

The invention provides a cargo container having a frame assembly, two sidewalls, a roof and at least one pivoted door including a portion of the roof and one sidewall and movable between a first, closed position and a second, open position, and energy storage means for providing a force to the door urging the door away from the said first position toward the said second position.

One form of trailer that is a container constructed in accordance with the invention has at least one gull-wing door extending longitudinally along the trailer. The gull-wing door permits unhindered access to the interior of the trailer along its full length at one time. The gull-wing door is pivoted along a longitudinal axis in the approximate centre of the roof and includes approximately one-half of the roof width as well as the total height of the adjacent contiguous sidewall. Left and right pairs of gull-wing doors as well as multiple doors on one side of the trailer are included within the scope of the invention. The doors are preferably opened by hydraulic cylinders, or other actuator devices disposed between the trailer frame and each end of each gull-wing door. In order to minimize intrusion into the cargo space, the hydraulic cylinders are then disposed substantially horizontally when the door is closed and open to a small acute angle when the door is unlatched. Energy for this initial opening motion of the door is preferably provided by torsion-bar spring assemblies disposed colinearly with an axis of pivoting of the door. The spring assemblies also provide force which assists the upward, opening motion of the door. The torsion-bar spring assemblies store energy while the door is being lowered to its closed position. Latching mechanisms disposed within the gull-wing door secure it to the trailer bed. Through operation of the latches and opening of the gull-wing door or doors by the hydraulic cylinders, un-

restricted access to the trailer along its full length can be rapidly and expeditiously achieved.

It is possible to provide a trailer constructed in accordance with the invention having at least one gull-wing door which extends along one side and provides access thereto, wherein opening mechanisms occupy a small volume and thus interfere little with the cargo-carrying capability of the trailer, and wherein auxiliary energy storage devices assist the opening of the door.

One form of trailer constructed in accordance with the invention will now be described by way of example with reference to the accompanying drawings, in which:

*Figure 1* is a perspective view of the trailer with gull-wing doors in their open positions;

*Figure 2* is a perspective view of the trailer with the doors in their closed positions;

*Figure 3* is a fragmentary plan view of the trailer as shown in *Figure 2*;

*Figure 4* is a fragmentary, side elevational view showing a door latch assembly in an open position;

*Figure 5* is a view similar to *Figure 4*, showing the door latch assembly in the closed position;

*Figure 6* is a fragmentary perspective view showing a door alignment assembly as seen from the outside of the trailer;

*Figure 7* is a fragmentary perspective view showing a door alignment assembly as seen from the inside of the trailer;

*Figure 8* is a fragmentary sectional view of a gull-wing door taken along the line 8-8 of *Figure 2*;

*Figure 9* is a fragmentary sectional view taken along the line 9-9 of *Figure 8*, through a hinge of the gull-wing door;

*Figure 10* is a fragmentary sectional view taken along the line 10-10 of *Figure 2*, through a gull-wing door seal;

*Figure 11* is a fragmentary sectional view taken along the line 11-11 of *Figure 3*, showing portions of the roof, roof seal and actuator mechanism;

*Figure 12* is a fragmentary plan view of the trailer with portions broken away, showing a gull-wing door-hinge assembly and a torsion-bar spring assembly;

*Figure 13* is a fragmentary sectional view taken along the line 13-13 of *Figure 11*, through the torsion-bar spring assembly;

*Figure 14* is a fragmentary section taken along the line 14-14 of *Figure 12*, through the torsion-bar spring assembly;

*Figure 15* is an exploded perspective view of one of the torsion bar spring assemblies;

*Figure 16* is an exploded perspective view of a gull-wing door hinge assembly;

*Figure 17* is a perspective view of a gull-wing door torsion-bar spring assembly and actuator assembly;

*Figure 18* is a fragmentary section taken along the line 18-18 of *Figure 11*, showing an actuator assembly of a gull-wing door in the closed position; and

*Figure 19* is a fragmentary sectional view similar to *Figure 18* showing the actuator assembly after

the latching mechanisms have been disengaged and the energy stored in the torsion-bar spring assembly has moved the gull-wing door out of its closed and latched position.

5 Referring to the accompanying drawings, and initially to Figures 1 to 3, a trailer indicated generally by the reference numeral 10 includes an elongate frame assembly 12 comprising a pair of parallel, elongate I-beams 14 to which are secured a plurality of spaced-apart crossbeams 16, oblique braces 18 and, towards the front of the trailer 10, a pair of landing gear 20 and a kingpin 22. Disposed towards the rear of the trailer 10 and secured to the I-beams 14 is an axle assembly 24 which includes suspension and brake components (not shown) and which rotatably supports a plurality of wheels and tyres 26. Also disposed towards the rear of the trailer 10, adjacent to the axle assembly 24, is an optional lift assembly 28 utilized to position the trailer 10 level with a loading dock. The lift assembly 28 is not essential to a trailer according to the invention. The frame assembly 12 also includes a peripheral rail 30 which extends generally about the trailer 10 in a conventional manner. The peripheral rail 30 is preferably a right-angle beam but may be a channel or I-beam, as desired. Supported by the I-beams 14 and the crossbeams 16 and extending between the peripheral rails 30 are a plurality of elongate, parallel wood planks which form a floor 32 of the trailer 10. The trailer floor 32 may instead be fabricated of metallic or wood composition sheets or plates, if desired.

As those familiar with cargo trailers will readily appreciate, the trailer 10 shown in the drawings is what is commonly referred to as a drop-frame trailer, wherein the floor 32 is at a generally higher level adjacent to the kingpin 22 and drops to a lower level along the remainder of the trailer 10 in order to maximize the internal cargo carrying volume of the trailer. With such a trailer floor configuration, two gull-wing doors, a forward door assembly 40 and an aft door assembly 42 having a height somewhat greater than the forward door assembly, are preferably utilized to provide floor-level access to both portions of the floor 32 of the trailer 10. In a trailer of a flatbed design, that is, one having a uniform floor height along its entire length, a single gull-wing door may be utilized to provide access along its full length. It should thus be appreciated that the following description relating to a drop-frame trailer should be considered illustrative and exemplary of one embodiment of a gull-wing trailer and should not be considered limiting. Likewise, although the trailer 10 described herein and shown in the accompanying drawings incorporates gull-wing doors 40 and 42 only on one side, the right side, it should be understood that trailers having gull-wing doors on the left side and trailers having gull-wing doors on both sides are within the scope of the present invention.

The trailer 10 also includes a front wall 44 which extends upwardly from the forward termini of the I-beams 14, a roof 46 and a fixed sidewall 48. As noted above, however, the roof 46 and the sidewall 48 may be elements of a gull-wing door or doors,

such as the doors 40 and 42, if it is desired, for various reasons, to provide access either to the left side of the trailer 10 or to both sides of the trailer 10. At the rear of the trailer 10, a pair of conventional hinged rear doors 50, each of which extends one-half the width of the trailer 10, together provide access to the interior of the trailer 10 in a conventional manner. A frame member 52 disposed at the step in the floor 32 between its higher and lower levels supports various elements of the gull-wing doors 40 and 42 as well as providing a sealing surface as will be more fully described subsequently. Each of the gull-wing doors 40 and 42 includes at least two latch assemblies 54 and larger gull-wing doors such as the aft door 42 preferably include door alignment assemblies 56. Also associated with each of the gull-wing doors 40 and 42 are a pair of actuator assemblies 58. A torsion-bar spring assembly 60A is operably connected between the forward gull-wing door 40 and the roof 46 and a pair of torsion-bar spring assemblies 60B and 60C are operably connected between the aft gull-wing door 42 and the roof 46. These various assemblies of the trailer 10 will be described below beginning with the latch assemblies 54.

Referring now to Figures 4, 5 and 8, each of the latch assemblies 54, which are disposed in spaced-apart relationship along the length of the gull-wing doors 40 and 42, includes a recessed frame 70 within which is disposed a manually-operable pivoted handle 72 movable between a first position, shown in Figure 4, wherein the gull-wing door 40 or 42 may be opened and a second position, as shown in Figure 5, wherein the gull wing door 40 or 42 is secured to the peripheral rail 30 of the frame assembly 12. Through a pivotally secured link 74 the handle 72 is coupled to a locking pin 76. The locking pin 76 is slidably received within a bushing 78 secured to the recessed frame 70 and is received at its opposite end within a stabilizing bracket 80. The lower terminal portion of the locking pin 76 preferably includes an obliquely oriented, outwardly facing surface 82. A suitably disposed aperture 84 formed in the peripheral rail 30 receives the terminal portion of the locking pin 76 and cooperates with the obliquely oriented surface 82 to provide a wedging action which securely closes the door when the handle 72 is moved from the position illustrated in Figure 4 to that illustrated in Figure 5. The latch assembly 54 may also include a spring clip 86 disposed within the frame 70 which positively maintains the handle 72 and thus the locking pin 76 in the position shown in Figure 4 during, for example, opening of the associated gull-wing door 40 or 42. The spring clip 86 may conveniently be manually depressed by an operator so that pivoting motion of the handle 76 may be readily accomplished when desired.

Referring now to Figures 6 and 7, one of the door alignment assemblies 56 disposed on the aft gull-wing door 42 will now be described. Generally speaking, the door alignment assemblies 56 are required only on larger gull-wing doors such as the gull-wing door 42 which extends along the lower, longer portion of the trailer 10. The door alignment

assemblies 56 are intended to facilitate engagement of the latch assemblies 54 described above by ensuring that the gull-wing door 42 is properly positioned before the latch assemblies 54 are moved to their closed positions. The door alignment assemblies 56 ensure that this can be accomplished notwithstanding flexing or deformation of the aft door 42, and especially of the frame assembly 12, due to uneven loading, uneven ground support or any other influence, which might render insertion of the locking pins 76 within the sockets 84 difficult. The door alignment assemblies 56 include a cooperating cone 90 and socket 92 which will be engageable to some extent, in spite of a degree of door or frame flexing and possible misalignment as described above. Associated with each cone 90 and socket 92 is a pivoted arm 94 which extends through the gull-wing door 42 and is pivotally secured thereto. The portion of the lever arm 94 outside the trailer 10 is manually operable and may, like the latch assembly 54, be disposed within a recessed frame 100. The lever arm 94 includes a centrally disposed slot 96 which may be engaged by a spring-biased latch 98. The latch 98 retains the lever arm 94 in the recessed frame 100, and may be made to release it with the application of upward force thereto. The portion of the lever arm 94 on the inside of the gull-wing door 42 includes tapered lateral edges and defines a generally narrowed end portion 102. Aligned with the end portion 102 of the lever arm 94 and disposed in the peripheral rail 30 is a slot 104. The slot 104 receives the end portion 102 of the lever arm 94. Upward motion of the portion of the lever arm 94 outside the trailer 10 urges the door 42 against the rail 30 and the cone 90 into the socket 92, thus appropriately positioning the gull-wing door 42 relative to the peripheral rail 30 such that the locking pins 76 of the latch assemblies 54 may be engaged as described above. Disposed generally along the inner, lower marginal edge of each gull-wing door 40 and 42 is disposed a leaf spring 106. The leaf spring 106 both provides a seal along the lower edge of the gull-wing doors 40 and 42 and provides an initial opening force which urges the gull-wing doors 40 and 42 away from the peripheral rail 30 when the latch assemblies 54 are moved to their open positions.

Referring now to Figures 8 and 9, a weather-tight seal between the gull-wing doors 40 and 42 and either the roof 46 of the trailer 10 or another gull-wing door is achieved along the length of the trailer 10 by a flexible seal 110. The flexible seal 110 may be of a material such as rubber, or a similar elastomer, or any other material which maintains suitable flexibility and waterproof characteristics over a broad range of temperatures. Each edge of the flexible seal 110 is received within a respective one of a pair of symmetrical, opposed slots 112A and 112B formed in longitudinally extending channel beams 114A and 114B, respectively. The channel beams 114A and 114B are preferably extrusions and thus uniform along their length. Secured to the channel beams 114A and 114B are various hinge structures such as right-an-

gle brackets 116 secured to the beam 114A and an interengaging tongue 118 secured to the beam 114B. The brackets 116 and the tongue 118 include aligned apertures within which a hinge pin 120 is positioned. The hinge pin 120 defines the longitudinal axis of pivoting of the gull-wing door 42 as well as functioning as a load carrying member, cooperating with the brackets 116 and the tongue 118. The hinge structure just described provides a positive pivot and, in trailers having doors on only one side, a load transfer point, as noted. However, additional hinges and pivots are utilized to couple the gull-wing doors 40 and 42 to the trailer 10 and are described below.

Referring now to Figures 10 and 11, the frame member 52 is formed to define a pair of channels 124A and 124B which receive a resilient gasket 126 of generally circular cross-section fabricated of rubber or a similar elastomer or other material which retains its resiliency over a wide range of temperatures. The gasket 126 seals against the back side of the gull-wing doors 40 and 42 to provide a weather-tight seal when the gull-wing doors are in their closed positions. The edges of the gull-wing doors 42 and 40 preferably include rolled lips 128A and 128B, respectively, which increase the area of the surface of the gasket 126 that contacts and forms a seal with the doors and thus enhance the seal. It should be understood that the seal structure of the forward gull-wing door 40 is in all respects identical to that shown in Figure 10 with regard to the aft gull-wing door 42. Furthermore, it should be understood that if a single gull-wing door which extends the whole length of a trailer is utilized, the seal structure illustrated will be located at the extreme front and rear of the gull-wing door, that is to say, the gasket 126 will be positioned in the channel 124A which will be defined by a portion of the extreme forward and aft frame structures of the trailer 10. Likewise in Figure 11, which illustrates, in section, a portion of the roof section of the gull-wing door 42, the channel 124A and the gasket 126 as well as the rolled lip 128A are all seen to extend into that region and provide the same sealing function as just described. Figure 11 also shows a portion of one of the actuator assemblies 58 which are disposed adjacent to the roof portions of the gull-wing doors 40 and 42 as will be more fully described subsequently.

Referring now to Figures 12 to 16, the torsion-bar spring assemblies 60A, 60B and 60C will be described. The spring assembly 60A is coupled to the forward gull-wing door 40, the spring assembly 60B is coupled to the forward region of the aft gull-wing door 42 and the spring assembly 60C is coupled to the rear region of the aft gull-wing door 42. At the outset, it should be understood that the configurations of the three torsion-bar spring assemblies 60A, and 60C vary in sense, that is to say, both left-hand and right-hand assemblies are used, and in size, depending upon the weight of the associated gull-wing door and the number of torsion-bar spring assemblies associated with that door to provide appropriate energy storage and thus to generate appropriate forces assisting opening of

the door. Notwithstanding these variations, the overall construction and function of the torsion-bar spring assemblies 60A, 60B and 60C is substantially the same for all three assemblies. In other words, similarities outnumber differences in the three torsion bar spring assemblies 60A, 60B and 60C and the differences relate simply to matters of orientation and spring torque. With the foregoing in mind, the torsion spring assembly 60B at the forward end of the aft gull wing door 42 will be described. Distinctions between it and the spring assemblies 60A and 60C will then be noted. A sub-frame 132 is secured to the frame member 52 and disposed generally proximate to the axis of pivoting of the gull wing door 42. The sub-frame 132 may be assembled from various structural shapes which may be secured together to form the following necessary elements. A folded bar forms a clevis 134 which defines a slot 136. The slot 136 receives a hinge component 138 which is secured to the gull wing door 42. The hinge component 138 includes an aperture 140 which aligns with a pair of similarly sized apertures (not visible in the drawings) in the clevis 134. The apertures in the clevis 134 are colinear with the axis of the hinge pin 120 previously described. The aligned aperture 140 and apertures in the clevis 134 receive a hinge pin 142 which secures the gull-wing door 42 to the sub-frame 132 and is retained there by a cotter pin 144 or other suitable removable fastener. The hinge component 138 and the sub-frame 132 function as significant load bearing and load-transferring components for the weight of the doors 40 and 42, especially in trailers having doors on both sides. The sub-frame 132 also includes a pair of plates 148 which define a cavity 150 having the common axis of the hinge pins 120 and 142 disposed at its centre. A shim plate or plates 152 may be utilized as necessary to reduce the cavity 150 to the correct size. The cavity 150 receives a plurality of flat, elongate torsion-spring bars 154. The length, number and thickness of the torsion bars 154 is chosen to provide a suitable opening torque for the gull-wing door 42 both when the latch assemblies 54 are released and during upward motion of the door 42 as will be described below. The precise dimensions and spring rates of the bars 154 will thus vary with the application and can be chosen according to conventional design practices and the shim plates 152 may be used to compensate for thickness variations of the bars 154. The torsion bars 154 are contained within an elongate tube 156 having a length somewhat shorter than the length of the bars 154. The elongate tube 156 ensures that the spring bars 154 remain generally disposed along the axis of pivoting of the gull-wing door 42 and further functions as a hinge pin since it is received within tripartite hinge assemblies 158 each comprising a pair of tube-receiving bushings 160A secured to the gull wing door 42 and disposed on opposite sides of a single bushing 160B secured to the roof 46 and supporting structural members (not shown) of the trailer 10 by associated mounting plates 162A and 162B, respectively. It is preferable that each of the two torsion spring assemblies

60B and 60C associated with the larger, aft gull wing door 42 includes three tripartite hinge assemblies 158, as shown in Figure 12. However, the torsion-bar spring assembly 60A associated with the forward gull wing door 40 preferably includes only two of the spring bars 154 and the cavity 150 of the sub-frame 132 then includes appropriate compensating shim plates 152. The end portion of each of the torsion-spring bars 154 remote from the sub-frame 132 includes an aperture 164. The ends of the springs 154 including the apertures 164 are coupled to a mounting block 166B secured to the gull wing door 42 by suitable fasteners (not shown). The mounting block 166B includes a horizontal slot 168 which receives the torsion springs 154. A suitably disposed aperture 170 aligns with the apertures 164 in the spring bars 154 and permits passage of a threaded fastener 172 or other suitable retaining means through the mounting block 166B to retain the spring bars 154 securely in the mounting block. It should be noted that no axial restraint is applied to the opposite ends of the bars 154, that is, the ends disposed within the cavity 150, and thus the bars 154 are free at one end so that longitudinal dimensional change occasioned by operation may readily occur.

Figure 14 illustrates the mounting block 166A of the torsion spring assembly 60A associated with the forward gull-wing door 40. As noted above, since the forward gull-wing door 40 is smaller than the aft gull-wing door 42, it has been determined that two elongate torsion spring bars 154 provide sufficient opening force. In Figure 14, a slot 174 which receives the spring bars 154 is shown. It will be noted that the slot 174 is disposed at an acute angle relative to the plane of the roof portion of the door 40. The approximate size of the acute angle can be determined with reference to Figure 1 which shows the gull-wing door 40 in its open position. Generally speaking, the angle of the spring-receiving slot 174 is such that the spring bars 154 of the spring assembly 60A are substantially or fully relieved of torsion in the open position since, first of all, there is no particular justification for storing energy at this point in the travel of the gull-wing door 40 and since, second of all, this arrangement facilitates assembly since the bars 154 can be installed without contending with torsional or preloading forces. Also as illustrated in Figure 1, it has been found preferable to include two torsion bar spring assemblies 60B and 60C with the larger, aft gull-wing door 42. The torsion bar spring assembly 60B shown in Figure 12 associated with the forward portion of the aft gull-wing door 42 may be considered to have a certain sense. A similar assembly 60C, which is opposite only in sense, is associated with the rearward portion of the aft gull-wing door 42 and is shown in Figure 1.

Referring now to Figures 16 and 17, each gull-wing door 40 or 42 is provided with a pair of actuator assemblies 58 as shown in Figure 1. Each of the sub-frames 132 also includes a transversely disposed pivot member 180 which defines a longitudinally oriented aperture 182. The pivot member 180 receives a clevis portion 184 of a hydraulic cyl-

inder 186. The clevis portion 184 includes a pair of aligned apertures 188. A pivot pin 190 extends through the apertures 188 and 182 and retains the hydraulic cylinder 186 on the pivot member 180 of the sub-frame 132. Suitable removable fasteners such as cotter pins 192 may be used to secure the pivot pin 190 releasably. The hydraulic cylinder 186 is a conventional, double acting type and, as such, includes a piston rod 196 extending from the end opposite the clevis portion 184 which may be extended and retracted by the appropriate application of pressurized hydraulic fluid. The piston rod 196 in turn includes a clevis 198 which is pivotally pinned to a bracket or structural member 200 of the gull-wing door 42. Again, it should be understood that while the foregoing description has related to the forward portion of the larger, aft gull-wing door 42, reference to Figure 1 will clarify the fact that an actuator assembly 58 is positioned as described at the forward and aft portions of both the forward gull-wing door 40 and the aft gull-wing door 42. It should therefore be understood that a pair of hydraulic cylinders 186 is preferably associated with each gull-wing door whether the gull-wing door is small like the gull-wing door 40 or is large like the aft gull-wing door 42 and extends substantially or completely along the length of the trailer 10.

Reference to Figures 18 and 19 as well as generally to Figures 1 and 2 and those drawings showing the torsion-bar spring assemblies 60A, 60B and 60C will clarify their function and the overall operation of the doors 40 and 42 of the trailer 10. When the aft gull-wing door 42, as shown in Figure 18, or the forward gull-wing door 40, is in its closed position, with the latch assemblies 54 engaged, it will be appreciated that the hydraulic cylinder 186 is oriented at only a few degrees from the horizontal. Such disposition is preferable since it occupies minimal vertical height and thus occasions minimum interference with the internal volume and thus with the cargo holding capability of the trailer 10. However, in that position the force exerted by the cylinder 186 acts along a line passing very close to the axis of pivoting of the door 42, as a result of which the moment of that force tending to open the door is minimal. When the latch assemblies 54 are moved from their engaged positions, as shown in Figure 5, to their released positions, as shown in Figure 4, thus releasing the locking pins 76 from engagement with the apertures 84 disposed in the peripheral rail 30, both the energy stored in the leaf spring 106 disposed along the lower marginal edge of the gull-wing door 42 and, primarily, the energy stored in the elongate torsion spring bars 154 of the torsion bar spring assemblies 60B and 60C initially opens and lifts the gull-wing door 42 to the position illustrated in Figure 19. It will be appreciated that although the repositioning of the gull-wing door due to the leaf spring 106 and the torsion-bar spring assemblies 60B and 60C is slight, the hydraulic cylinder 186 is now disposed at a far more mechanically advantageous alignment to provide lift to the gull-wing door 42. At this time, pressurized hydraulic fluid is provided

to the hydraulic cylinders 186 and the gull-wing door 42 may be moved to the elevated position illustrated in Figure 1. It should be understood that operation of the forward gull-wing door 40 follows the same procedure.

Closing of the gull wing doors 41 and 42 entails simply the reverse application of hydraulic fluid to the cylinders 186 to return the gull-wing doors 40 and 42 to generally the position shown in Figure 19. The doors are then manually pressed closed to the position shown in Figure 18, a process which may be assisted by the door-alignment assemblies 56 preferably included on any larger gull wing doors such as the aft gull-wing door 42. The latch assemblies 54 may then be engaged and the trailer is secure for movement.

The hydraulic system used to provide controlled, pressurized hydraulic fluid to the double-acting hydraulic cylinders 186 of the actuator assemblies 58 may be of a conventional nature and will typically be integrated with a similar system on a tractor associated with the trailer 10. The hydraulic system will therefore not be further described.

It is thus possible to construct a trailer 10 according to the invention that is capable of providing rapid and unrestricted access along its length. It should be understood that the frame member 52 would be unnecessary in a trailer having a floor at uniform height extending its full length. The substantially horizontal disposition of the hydraulic cylinders of the actuating assemblies 58 as shown in Figure 18 provides very little incursion into the cargo space and thus very little interference with the cargo-holding and hauling capability of the trailer 10 while providing rapid opening and closing of the gull-wing doors 40 and 42.

#### CLAIMS

1. A cargo container having a frame assembly, two sidewalls, a roof and at least one pivoted door including a portion of the roof and one sidewall and movable between a first, closed position and a second, open position, and energy storage means for providing a force to the door urging the door away from the said first position toward the said second position.
2. A container as claimed in claim 1, including a plurality of latch means for securing the door to the frame assembly, the latch means including a manually operable lever and a locking pin coupled to the lever and movable between a first, retracted position and a second, extended position.
3. A container as claimed in claim 1 or claim 2, wherein the energy storage means is disposed generally along an axis of pivoting of the door relative to the rest of the container.
4. A container as claimed in any one of claims 1 to 3, wherein the energy storage means comprises a spring.
5. A container as claimed in both claim 3 and claim 4, wherein the energy storage means includes torsion-bar spring means disposed generally along the axis of pivoting of the door.
6. A container as claimed in claim 5, wherein

the torsion-bar spring means includes at least two torsion bars disposed side-by-side.

7. A container as claimed in claim 5 or claim 6, wherein the torsion-bar spring means is disposed within an elongate tube.

8. A container as claimed in claim 7, wherein the elongate tube is received within a plurality of annular bushings, at least one of which is secured to the door and at least one of which is secured generally to the roof of the container, and the elongate tube functions as a hinge pin disposed along the axis of pivoting of the door.

9. A container as claimed in any one of claims 1 to 8, comprising a plurality of said energy storage means for providing a force to the said door.

10. A container as claimed in any one of claims 1 to 9, including actuator means for moving the door to the said second position from a third position adjacent to the said first position.

11. A container as claimed in claim 10, wherein the actuator means includes hydraulic cylinder means.

12. A container as claimed in claim 11, wherein the hydraulic cylinder means are double acting.

13. A container as claimed in any one of claims 1 to 12, comprising hinge means pivotally securing the said door to the roof of the container.

14. A container as claimed in claim 13, wherein the hinge means defines an axis of pivoting extending longitudinally of the container.

15. A container as claimed in any one of claims 1 to 14, comprising at least two said doors.

16. A container as claimed in any one of claims 1 to 15, including a pair of rear doors providing access to the interior of the container, the rear doors being pivotally disposed on a pair of spaced-apart vertically oriented axes.

17. A container as claimed in any one of claims 1 to 16, which is a trailer.

18. A trailer as claimed in claim 17, which is a semi-trailer for an articulated lorry.

19. A trailer substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.